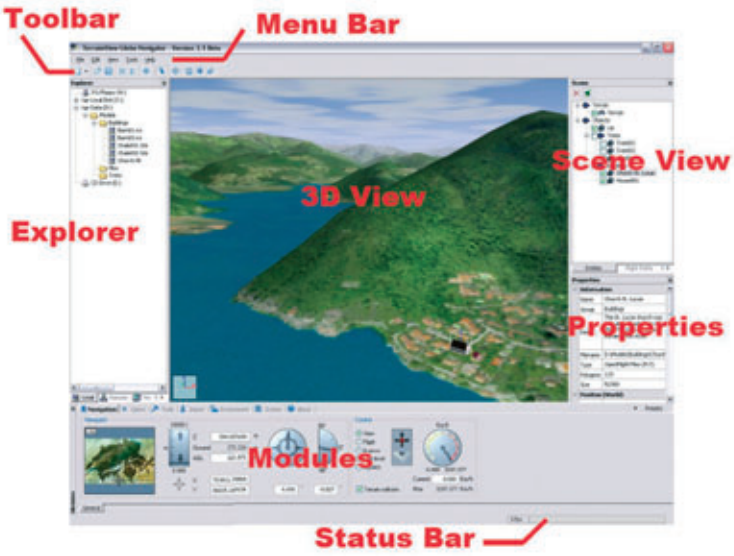
3D Visualization; What is it, an

Review ViewTec's TerrainView

According to the American Planning Association, 3D Visualization models have many applications in urban studies: site location analysis, emergency facilities planning, design review, and presentations to the public. 3D Visualization has made its way into the study of Geography, and recently through advances in web technology there is a great deal of rich content available in 3D delivered directly over the World Wide Web.

By Greg Baca



The Graphical User Interface (GUI).

Better Understanding

I have witnessed first hand the ability to capture and hold an audience's attention with 3D visualization at city planning sessions with site selection, and view shed analysis scenarios presented to the audience in 3D.

The advent of faster, more capable computers, and advances in software and visualization science, enable modelling much of the world in realistic 3D visualizations providing a means to a better understanding of the terrain. The wide variety of 3D objects, such as trees, foliage, buildings, and surfaces help to make the 3D visualization a virtual reality. Much of the realism comes from lighting (angles, intensity, shadows, weather) and things like fog, sky color, clouds, rain, and snow. This application of the third dimension brings powerful qualities to the models we create to analyze our world.

Navigate

In this issue of GeoInformatics we take a look at ViewTec's TerrainView. TerrainView goes beyond 3D to virtual reality by not only displaying terrain, landscapes, objects and text in 3D, but allowing us to navigate through the terrain and providing the ability to add realistic weather visualization. TerrainView Globe is an additional module which adds spherical Earth rendering, and advanced functionality.

TerrainView bills itself as 'A Virtual Reality based Geographic Information System, offering, multi-resolution support and display of global and local scale imagery, elevation, and vector-based datasets'. The software offers navigation in a variety of ways which we will explore later in the article. It is possible to add text as a Point of Interest and to zoom to those Points of Interest. Furthermore there is the ability to import georeferenced 3D models, the capability to generate image sequences for digital video, as well as the ability to build flight paths through a scene.

Visualization - the act of visualizing; according to Merriam-Webster's Dictionary:
1: formation of mental visual images;
2: the act or process of interpreting in visual terms or of putting into visible form.

Geographic Three Dimensional (3D) Visualization gives us the ability to see and visualize our landscape extending geographic analysis beyond a mere set of numbers or what we might be seen with a two dimensional image.

Getting Started

On the initial opening of the TerrainView application the Graphical User Interface (GUI) seems rather busy, but after I had a chance to explore the application a bit further I found that I was able to arrange the various tools and windows as necessary - almost all windows are dockable. The documentation is well written, and well organized with a few grammatical oddities often apparent during the translation between English and other languages.

In the documentation I found a guide to work with a scene entitled 'Your First Scene'. Initially, you are instructed to load a previously completed scene as a vehicle for learning your way around the software and the interface. This is a good method to get the user familiar with the software before attempting to create a scene from scratch. Since TerrainView is a powerful application, there is a good deal to learn and understand before the user can be fluent in the application.

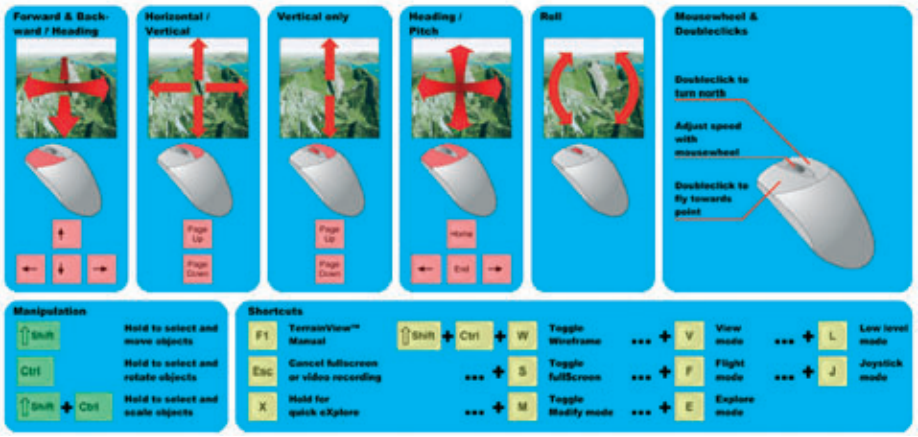
The Graphical User Interface

The Graphical User Interface (GUI) by default loads with standard elements such as the Menu, Toolbar, and Status Bar common elements one would find on any Windows application. Through the menu and Toolbar the user can access most commands specific

d What Are Some Uses for It?

to the application. TerrainView specific elements are the 3D View, where the scene is displayed. An Explorer provides access to data stored locally. on a network and from the web. The Scene View provides access to entities that can be loaded into a scene and accessed through tabs in the window, and the Properties for these; the Scene View tabs are Entities, Flight paths, Points of Interest, and Measurements.

'Entities' displays the terrain and objects that are loaded in the current view in a tree form where each can be expanded or contracted to show more or less detail. 'Measurements' store measurements that can be added to a scene for measurements of distance, angle, profile, and area. 'Flight paths' define a series of points representing camera point of view that define a 'flight' or a 'drive' through a scene. Points of interest define a point where text can be added to the scene, font, angle, elevation and other properties can be defined for the point of interest. Most of the application functionality is accessed through the Modules element; Navigation, Tools, Options, Environment, Import, System and About, along with applicable submenus, or dialogs are provided in Modules.



Scene Navigation key chart.

The Configuration File

TerrainView defines a Configuration as any scene consisting of terrain, 3D models, flight paths, points of interest, and weather conditions. These can be saved in configuration files for instant access in future sessions and are stored as a .tvc file.

Navigation

After the TerrainView Configuration file is loaded the first thing to master is navigation through the scene. TerrainView defines a Scene as 'The Virtual World visualized based on the configuration and the data, terrain is defined as the entity that represents the ground'. Navigation is found in the Modules element, and is rich in possible ways to get around in the scene, and through 'Control' provides a number of methods to approach the navigation.

Fortunately ViewTec provides a nice chart of keys and commands to illustrate scene navigation. I mostly used the mouse navigation methods, yet was able to tweak specifics such as direction, tilt angle and the like with the navigation panel itself. With a little practice I was able to navigate scenes with relative ease.

Flight Paths

Flight Paths provide another way to get around a scene. There are paths that follow the ground much as one might do walking or driving in a car, or paths defined above the ground in the air as one might see from an airplane. Flight paths are defined point by point as though each point represents an imaginary camera's position and view angle. Movement between points can be interpolated in a variety of ways and the default is a spline curve which provides for a smooth transition between points on playback. Factors such as speed, angle, interpolation between points, and the frequency of points make a significant difference on how good the flight plays back. Building flight paths takes a good deal of practice in order to get satisfactory results.

A unique feature to TerrainView is to add an object such as a car or helicopter to the path and then set a delay as to portray following that object, such as a car, helicopter, or airplane.

3D objects can of course, be added to the scene. Each individual object loaded in the scene can be manipulated in space as to location orientation and tilt with respect to the X, Y, and Z axes (Translate, Rotate and Scale). Adding and manipulating objects is relatively intuitive. Objects can be directly navigated to by right clicking the object in the Scene view tree, and choosing 'Jump to' or 'Fly to'.

The Navigation Module in TerrainView.

TerrainView provides a high level of detail with a realistic sense of motion.

Points of Interest

Adding Points of Interest is quite simple. These are text at a specific point; type, appearance, and decorations are properties that can be defined for a Point of Interest.

Measurements

Measurements are an important component of any analysis. Terrain View allows various kinds of 3D measurements to be made, like distances, angles, profiles and areas.

Flight Simulation; note the Weather simulation with the clouds in the sky.

Environments
My favourite aspect, and I think a distinguishing feature of TerrainView, is the ability to add fog, clouds and haze. Weather contributes to a much more realistic visualization. These settings can be found under the Environments tab of Modules. There are a number of settings for sky such as color, haze, and fog and varying color settings for time of day. For clouds, there are a variety of cloud types and parameters such as minimum and maximum height, distance, number of clouds, and other parameters. Even the addition of wind and rain are available options.

Points of Note

There are a wide variety of options and settings applying to how the application behaves and parameters specific to an individual scene. The list is too numerous to mention each one of them in this article, but worth mentioning is that all combine to make TerrainView a robust 3D application.
A critical aspect to analysis from a geographic standpoint is spatially correct portrayal of the data. TerrainView handles a variety of coordinate systems and georeferencing methods. By exporting a flight path TerrainView can generate videos of various resolution, and videos using different video codecs.
ViewTec supplies a host of modules and other applications for 3D visualization, one of significant note is Remote Control. As ViewTec states: 'TerrainView Remote Control is the core technology for dynamic 3D terrain monitoring and the tracking of mobile units and dynamic objects on the ground and in the air. TerrainView Remote Control supports the integration of signals, such as GPS, and imagery from various sources and sensors in an interactive 3D visualization environment'. TerrainView supports a number of input and output formats, in fact too many to list in this article. Those interested can have a look at www.viewtec.ch/techdiv/terrainview_e.html for a complete list.

System Requirements

Hardware: Minimum: Pentium IV / 2,4 Ghz, 512 MByte RAM, Graphics Board with OpenGL support and 128 MByte Texture RAM, PixelShader 1.4;
Operating System: Windows 2000/XP.

ViewTec, founded in 1998, is a spin-off company emerging from the University of Zurich, Department of Computer Science, Switzerland. ViewTec's core business covers the fields of Virtual Reality, 3D Computer Graphics and Scientific Visualization. Its customer base includes hospitals, real estate companies, art museums, tourist agencies and Department of Defense contractors. The projects cover applications such as interactive Virtual Reality (VR) environments, flight simulators, and medical imaging.
ViewTec's product range includes TerrainView, TerrainView-Web, TerrainView-Globe, FlightSim, MedView and Hugo. ViewTec also offers high resolution digital 3D databases covering the entire area of Switzerland, Europe and World. The 3D databases are distributed in various resolutions and qualities and for different ViewTec applications.
The ViewTec website also includes a great introduction to 'Computer Graphics, Scientific Visualization and Virtual Reality' at www.viewtec.ch/techdiv/vr_info_e.html.

ViewTec is also present at the INTERGEO exhibition.

Data Access Over the Web

TerrainView provides the capability to view in 3D over the web. ViewTec offers Geographic data and 3D models. TerrainView 3D scenes can be exported then accessed over the web.

Conclusion

TerrainView is a full function 3D Geographic Visualization system with the capability of providing significant analysis beyond visualization. In my opinion TerrainView does a good job of representing textures for landscapes, building sides, and rooftops. The application provides a high level of detail with a realistic sense of motion. 3D Objects are customizable as to how they are handled and the addition of environmental features such as haze and clouds make for a realistic experience.
TerrainView provides a host of options with which to configure the scene, or application, and provides methods to balance the ratio of speed/performance to the degree of rendering (graininess or blurring). As with any powerful software system one can't expect to become an expert instantly. With practice and a bit of RYDM (read your darn manual!) one can get data into TerrainView and begin visualizing their data for meaningful analysis.
As always data is a key factor; we must keep in mind the data fed into the application can have a significant impact on the viability of the model. One can think of aspects like accuracy, precision, currentness, and even the textures applied to the objects. TerrainView makes good on its claim that it is 'A Virtual Reality based Geographic Information System, offering, multi-resolution support and display of global and local scale imagery, elevation, and vector-based datasets'. I highly recommend taking a 'flight' through a 3D Scene with TerrainView.

Credits

ViewTec Credits the following: Building data, Cybercity AG, DEM and Orthophotos Endoxon AG and Swissphoto AG.

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